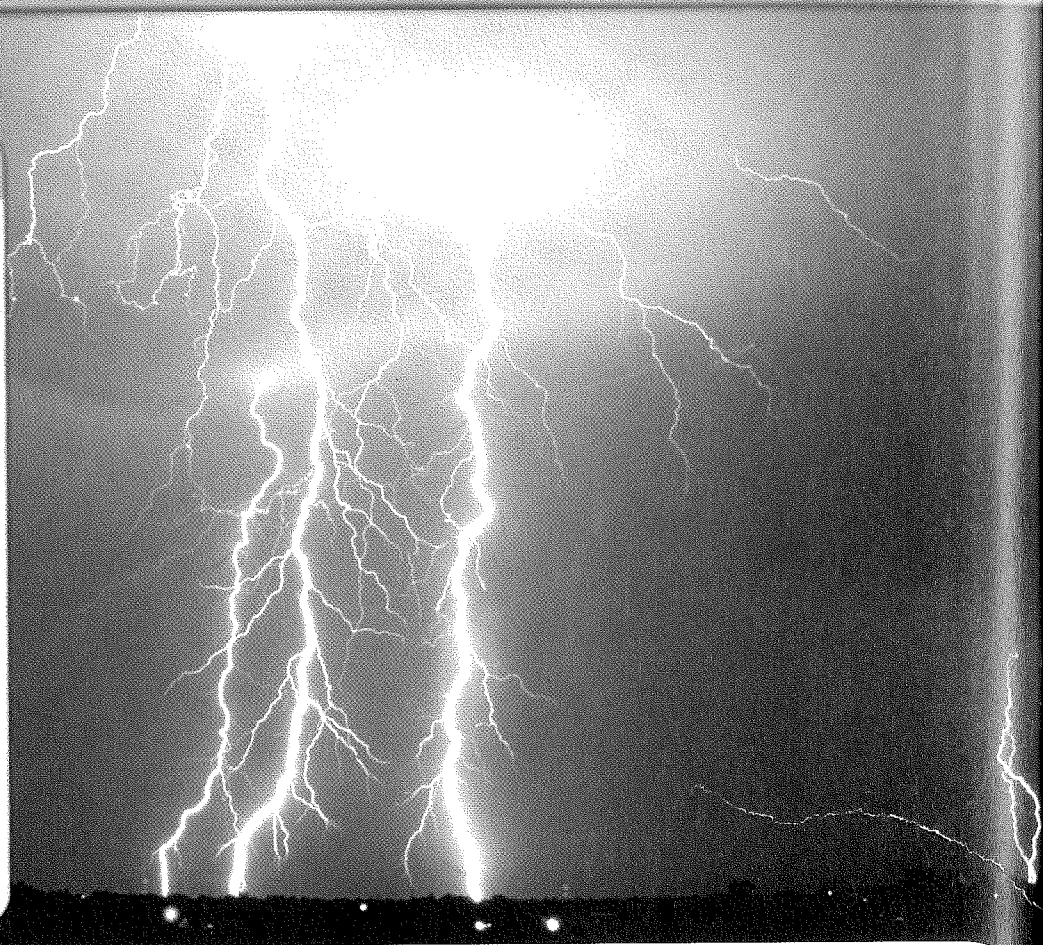


# Electricity occurs when there is an imbalance of charged particles.



## KEY IDEAS

- ▶ Everything contains charged particles.
- ▶ An electron is a negatively charged particle that forms part of an atom.
- ▶ An object is negatively charged when it has too many electrons and positively charged when it has too few electrons.
- ▶ Unlike electric charges attract, and like charges repel.
- ▶ Static electricity occurs when there is a buildup of electric charges on an object.



Have you ever seen a spectacular display of lightning, like the one in this photo? If you live in one of the drier parts of British Columbia, you've probably seen—and heard—a lot of electrical storms. Even if you have never seen lightning, it is occurring somewhere on Earth about 100 times every second!

When you think about electricity, you probably do not think about lightning. The electricity in lightning is an example of static electricity. What is static electricity? Is it the same as the electricity that runs appliances and makes life so convenient? In this chapter, you will discover what the lightning that flashes overhead has in common with the electricity that runs a CD player. Understanding electricity is one of the steps to understanding the world around you.

# What Is Electricity?

## 5.1

### TRY THIS: OBSERVE ELECTRICITY

**Skills Focus:** observing, communicating

Inflate a balloon, and put it against a wall. Watch what happens when you let the balloon go. Rub the same balloon with a wool cloth or your hair for a few seconds. Then put it against the wall. Observe what happens.

1. What happened to the balloon the first time?
2. What happened to the balloon the second time? How long did the balloon stay on the wall?
3. How can you explain what you observed?

When you think about electricity, you might think about plugging a hairdryer into a wall socket or running a CD player on batteries. However, you have experienced electricity in other ways. When your socks stick to each other in a clothes dryer, or when you rub a balloon on a wool sweater and then stick it to a wall, you are also experiencing a form of electricity (Figure 1).

To understand what electricity is, you have to look at **atoms**. Atoms are the tiny building blocks that make up everything around you—from the air you breathe to the clothes you wear. Everything is made of atoms. Each atom contains small particles that have an electric charge. Some particles have a **negative** charge ( $-$ ). These particles are called **electrons** [ih-LEHK-trons]. Other particles have a **positive** charge ( $+$ ). They are called protons. Since everything is made of atoms, everything contains charged particles.

Positive and negative charges pull, or attract each other. Most objects—including you, the chair you sit on, and this book—have an equal number of positive charges and negative charges. When the electric charges in an object are equal, or balanced, the object is neutral [NOO-truhl]. There are not any extra charges to attract something else. This is why a book does not stick to your hand and you do not stick to your chair.

So, why did the balloon that you rubbed with the wool cloth or your hair stick to the wall? What happens to make an object attract another object? The answer has to do with changing the electric charges in an object.



**Figure 1**

Thales, an Ancient Greek philosopher, noticed that when he rubbed amber (a yellow resin) with fur, it attracted feathers, threads, and leaves. The word “electricity” comes from the Greek word “*elektron*,” which means “amber.”



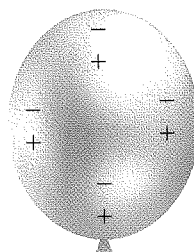
## LEARNING TIP

As you read this section, look at the figures and read the captions to check your understanding. If an idea isn't clear, reread the paragraph, and then look at the figure and read the caption again.

# How Do Electric Charges Work?

We can change the balance of electric charges in an object so that the charges are unequal, or unbalanced. When this happens, we say that the object is charged with electricity.

For example, when you hold a balloon against a wall, it does not stick. It has the same number of positive and negative charges, so the balloon is neutral, or uncharged (**Figure 2**). Since the balloon is not attracted to the wall, it falls to the floor.

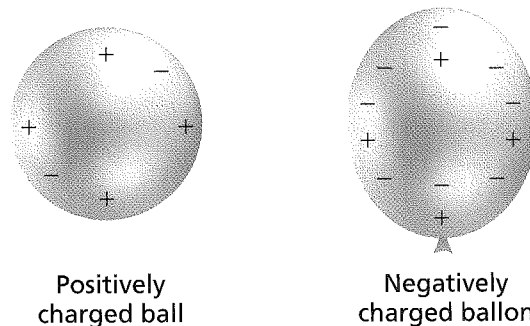


Neutral object

**Figure 2**

A neutral object, such as this balloon, has an equal number of positive charges (+ signs) and negative charges (- signs).

When you rub a wool cloth and a balloon together, both objects become charged. This does not mean that the rubbing creates the electric charges. The rubbing just moves the charges from their normal places. The rubbing knocks some electrons off the wool cloth, causing the cloth to change from being neutral to being positively charged. The balloon picks up the electrons and changes from being neutral to being negatively charged. **Figure 3** shows a positively charged ball and a negatively charged balloon.



**Figure 3**

A positively charged ball has more positive charges than negative charges.

A negatively charged balloon has more negative charges than positive charges.

# The Laws of Electric Charges

## TRY THIS: MAKE ELECTRIC CHARGES MOVE

**Skills Focus:** conducting, inferring, communicating

Inflate two round balloons. Tie each balloon with a string. Hang the two balloons close together from a metre stick or pole as shown in **Figure 4**. Rub one of the balloons with a wool cloth. Observe what happens. Then rub both of the balloons with the wool cloth. Observe what happens.

1. What happened when you rubbed one balloon? Why do you think this happened?
2. What happened when you rubbed both balloons? Why do you think this happened?



Figure 4

A positively charged wool cloth is attracted to a negatively charged balloon. Charged objects behave in certain ways according to the laws of electric charges. One of these laws states that objects with unlike charges attract one another (**Figure 5**). This means that if one object is negatively charged and another object is positively charged, they will move toward each other.

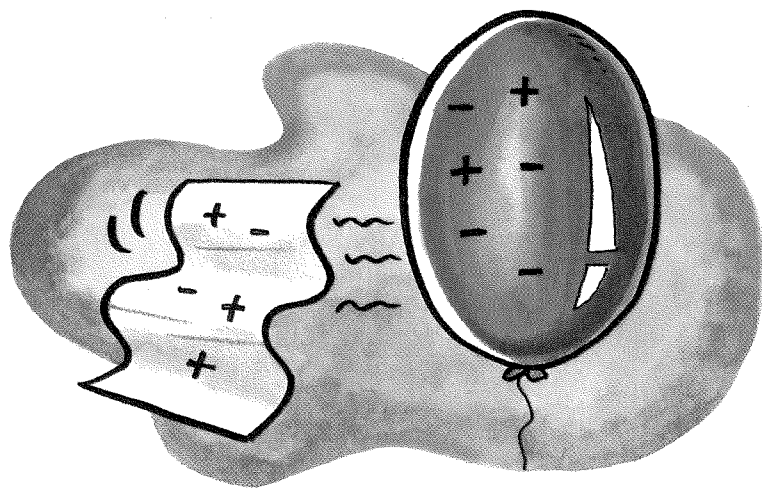


Figure 5

A negatively charged object attracts a positively charged object.

### LEARNING TIP ◀

Counting the + signs and the – signs on the objects shown in the figures will help you see whether the object is positively charged, negatively charged, or neutral.

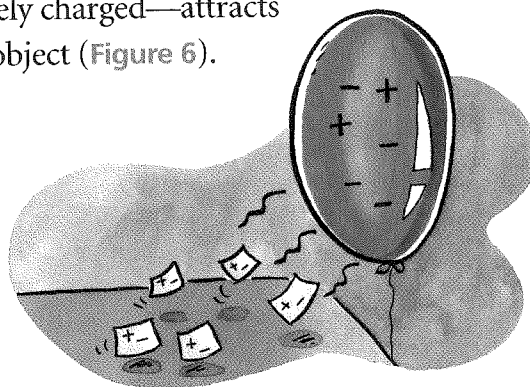




### ▶ LEARNING TIP

The laws of electric charges are usually stated this way: Unlike charges attract, like charges repel.

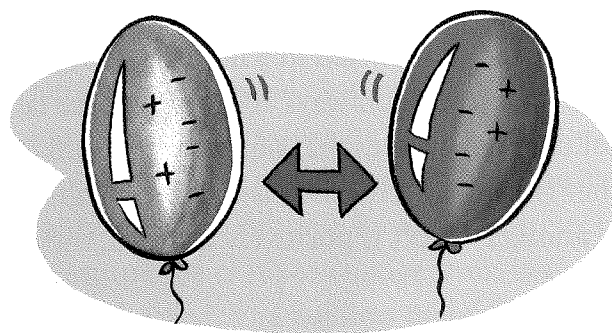
Have you ever noticed that after you rub your hair with a balloon, the balloon can pick up small pieces of paper? Try it and see! A charged object—either positively charged or negatively charged—attracts a neutral object (Figure 6).



**Figure 6**

A negatively charged balloon attracts neutral pieces of paper.

Another law of electric charges states that objects with like charges repel each other. This means that two positively charged objects, or two negatively charged objects, will push away from each other (Figure 7). Can you use the laws of electric charges to explain what happened to the two balloons in the Try This activity?



**Figure 7**

A negatively charged object repels another negatively charged object.

### ▶ CHECK YOUR UNDERSTANDING

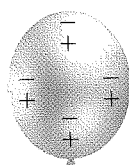
1. Use words and pictures to name and describe the two types of electric charges.
2. Read each description. Is the underlined object charged or neutral? Explain how you know.
  - Your sock is sticking to your shirt.
  - Two books are stacked on your desk.
  - You shuffle your feet across a carpet and get a zap when you touch a metal doorknob.
  - You are brushing your hair and notice that it begins to stand on end.
3. Use each pair of terms in a sentence.
  - attract, unlike charges
  - repel, like charges

# 5

## Chapter Review

Electricity occurs when there is an imbalance of charged particles.

**Key Idea:** Everything contains charged particles.



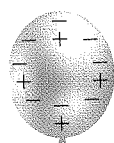
A neutral object has an equal number of positive charges and negative charges.

**Key Idea:** An electron is a negatively charged particle that forms part of an atom.

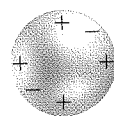


**Vocabulary**  
atoms p. 91  
electrons p. 91

**Key Idea:** An object is negatively charged when it has too many electrons and positively charged when it has too few electrons.



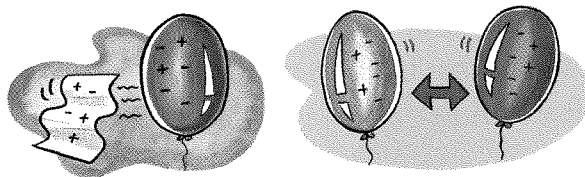
Negatively charged balloon



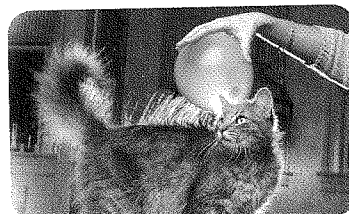
Positively charged ball

**Vocabulary**  
negative p. 91  
positive p. 91

**Key Idea:** Unlike electric charges attract, and like charges repel.



**Key Idea:** Static electricity occurs when there is a buildup of electric charges on an object.



**Vocabulary**  
static electricity p. 96

## Review Key Ideas and Vocabulary

When answering the questions, remember to use the chapter vocabulary.

1. What kinds of charged particles does an atom contain?
2. What is a negatively charged particle called?
3. Think about the number of negative and positive charges on an object. What can you say about an object that has a negative charge? What can you say about an object that has a positive charge?
4. Indicate whether each of the following objects would attract or repel each other:
  - an object with a positive charge and another object with a positive charge
  - an object with a positive charge and an object with a negative charge
  - an object with a negative charge and a neutral object
5. Suppose that you comb your hair using a plastic comb. When you finish, your hair is sticking to the comb. What has happened? How do you know?
6. List three ways that static electricity can be discharged. Give an example for each.
7. Explain where the lightning in the picture is likely to strike.



## Use What You've Learned

8. If you live in a dry area of British Columbia, you may see small sparks when you move your feet back and forth across your sheets at night. Explain what is happening.
9. Would it be better to wrap a sandwich in plastic wrap or wax paper? Explain why, in terms of static electricity.
10. Explain why static electricity is an uncontrolled form of electricity.

## Think Critically

11. How could you avoid getting a shock from static electricity when you touch a metal doorknob?
12. List three safety precautions that you should take if you are outside during a lightning storm.

## Reflect on Your Learning

13. What questions do you still have about static electricity? Do you think your questions will be answered in the rest of this unit? If not, where can you go to find the answers?